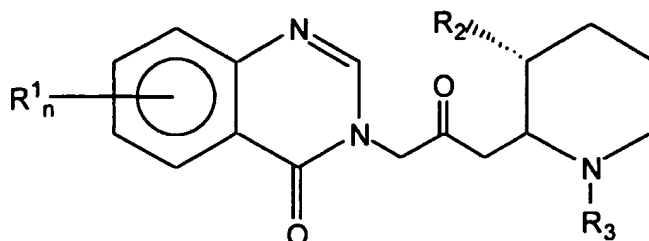


**CLAIMS:**

1. A method for improving liver regeneration comprising administering to an individual in need thereof a pharmaceutical composition comprising a therapeutically effective amount of a compound having the formula:

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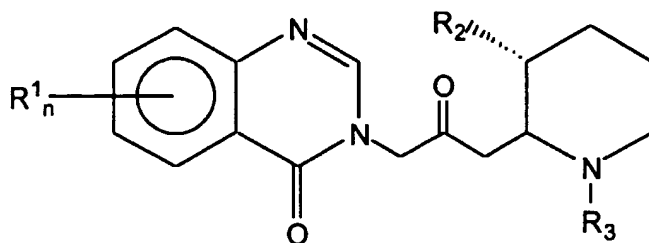


wherein:  $n=1-2$

- $R_1$  is at each occurrence independently selected from the group consisting of hydrogen, halogen, nitro, benzo, lower alkyl, phenyl and lower alkoxy;
  - $R_2$  is a member of the group consisting of hydroxy, acetoxy and lower alkoxy; and
  - $R_3$  is a member of the group consisting of hydrogen and lower alkenoxy-carbonyl, and pharmaceutically acceptable salts thereof.

2. The method according to claim 1 wherein the compound is halofuginone.
3. A method for treating or preventing pathological processes related to alterations in gene expression during fibrotic processes, comprising administering to an individual in need thereof a pharmaceutical composition comprising a therapeutically effective amount of a compound having the formula:

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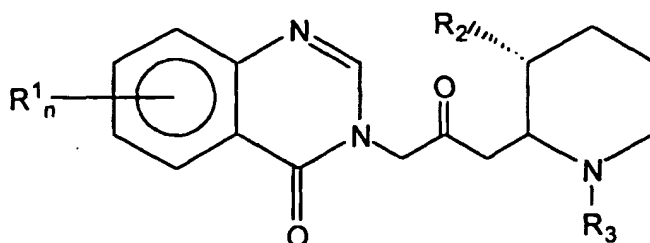
wherein:  $n=1-2$

R<sub>1</sub> is at each occurrence independently selected from the group consisting of hydrogen, halogen, nitro, benzo, lower alkyl, phenyl and lower alkoxy;  
R<sub>2</sub> is a member of the group consisting of hydroxy, acetoxy and lower alkoxy; and  
R<sub>3</sub> is a member of the group consisting of hydrogen and lower alkenoxy-carbonyl,  
5 and pharmaceutically acceptable salts thereof.

4. The method according to claim 3 wherein the compound is halofuginone.
5. The method according to claim 3 wherein the gene expression includes at least one  
10 gene selected from:
  - IGFBP-1 - Insulin like growth factor binding protein 1
  - IGFBP-3 - Insulin like growth factor binding protein 3
  - PRL-1 (PTP4A1)- protein tyrosine phosphatase 4A1
  - APO-AIV - Apolipoprotein A- IV precursor
  - 15 PI 3-kinase p85-alpha subunit
  - MAP kinase p38 - Mitogen activated protein kinase p38
  - Proteasome component C8
  - E-FABP - Epidermal fatty acid-binding protein
  - PMP- peripheral myelin protein (PMP-22/SR13)
  - 20 PCNA - proliferation cell nuclear antigen
  - Proteasome activator rPA28 subunit alpha
  - c-K-ras 2b proto-oncogene
  - ST2A2 - Alcohol sulfotransferase A, Probable alcohol sulfotransferase
  - TIMP-2 - Metalloproteinase inhibitor 2 (Precursor), Tissue inhibitor of
  - 25 metalloproteinase 2
  - MMP-3 - metalloproteinase 3
  - MMP-13 -metalloproteinase 13
6. The method according to claim 3 wherein the gene is a member of the IGFBP  
30 family.
7. The method according to claim 6 wherein the gene is IGFBP-1.

8. The method according to claim 5 wherein the gene is IGFBP-3.
9. The method according to claim 3 wherein the fibrotic process is liver fibrosis.

- 5 10. A method for treating or preventing pathological processes related to toxin induced alterations in gene expression comprising administering to an individual in need thereof a pharmaceutical composition comprising a therapeutically effective amount of a compound having the formula:



wherein:  $n=1-2$

$R_1$  is at each occurrence independently selected from the group consisting of hydrogen, halogen, nitro, benzo, lower alkyl, phenyl and lower alkoxy;

15  $R_2$  is a member of the group consisting of hydroxy, acetoxy and lower alkoxy; and

$R_3$  is a member of the group consisting of hydrogen and lower alkenoxy-carbonyl, and pharmaceutically acceptable salts thereof.

11. The method of claim 10 wherein the toxin is thioacetamide (TAA).

20

12. The method according to claim 10 wherein the compound is halofuginone.

13. The method according to claim 10 wherein the gene expression includes at least one gene selected from:

25 IGFBP-1 - Insulin like growth factor binding protein 1

IGFBP-3 - Insulin like growth factor binding protein 3

PRL-1 (PTP4A1)- protein tyrosine phosphatase 4A1

APO-AIV - Apolipoprotein A- IV precursor

PI 3-kinase p85-alpha subunit

MAP kinase p38 - Mitogen activated protein kinase p38

Proteasome component C8

E-FABP - Epidermal fatty acid-binding protein

PMP- peripheral myelin protein (PMP-22/SR13)

5 PCNA - proliferation cell nuclear antigen

Proteasome activator rPA28 subunit alpha

c-K-ras 2b proto-oncogene

ST2A2 - Alcohol sulfotransferase A, Probable alcohol sulfotransferase

10 TIMP-2 - Metalloproteinase inhibitor 2 (Precursor), Tissue inhibitor of  
metalloproteinase 2

MMP-3 - metalloproteinase 3

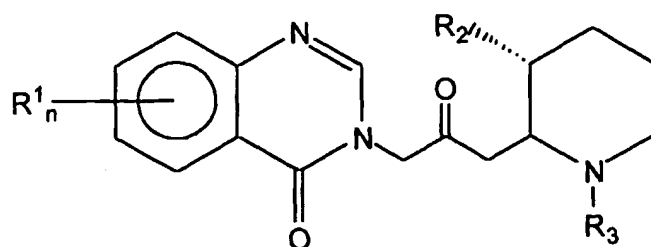
MMP-13 - metalloproteinase 13

14. The method according to claim 10 wherein the gene is a member of the IGFBP  
15 family.

15. The method according to claim 14 wherein the gene is IGFBP-1.

16. The method according to claim 14 wherein the gene is IGFBP-3.  
20

17. A method for treating hepatic cirrhosis by increasing the IGFBP-1 expression in  
hepatocyte cells comprising administering a pharmaceutical composition  
comprising a therapeutically effective amount of a compound having the formula:



25

wherein:  $n=1-2$

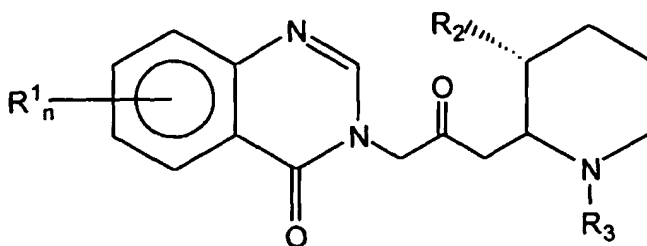
$R_1$  is at each occurrence independently selected from the group consisting of  
hydrogen, halogen, nitro, benzo, lower alkyl, phenyl and lower alkoxy;

$R_2$  is a member of the group consisting of hydroxy, acetoxy and lower alkoxy; and  
 $R_3$  is a member of the group consisting of hydrogen and lower alkenoxy-carbonyl,  
 and pharmaceutically acceptable salts thereof.

5 18. The method according to claim 17 wherein the compound is halofuginone.

19. A method for improving liver regeneration by increasing the IGFBP-1 expression  
 in hepatocyte cells comprising administering a pharmaceutical composition  
 comprising a therapeutically effective amount of a compound having the formula:

10

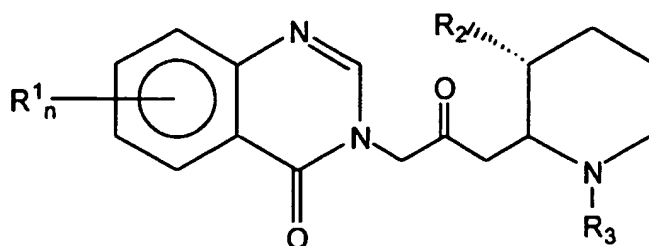


wherein:  $n=1-2$

15  $R_1$  is at each occurrence independently selected from the group consisting of  
 hydrogen, halogen, nitro, benzo, lower alkyl, phenyl and lower alkoxy;  
 $R_2$  is a member of the group consisting of hydroxy, acetoxy and lower alkoxy; and  
 $R_3$  is a member of the group consisting of hydrogen and lower alkenoxy-carbonyl,  
 and pharmaceutically acceptable salts thereof.

20 20. The method according to claim 19 wherein the compound is halofuginone.

21. A method for improving the capacity of a cirrhotic liver to regenerate following  
 partial hepatectomy by inducing gene expression of at least one gene selected from  
 IGFBP-1, PRL-1, MMP-3 and MMP-13 comprising administering a  
 25 pharmaceutical composition comprising a therapeutically effective amount of a  
 compound having the formula:

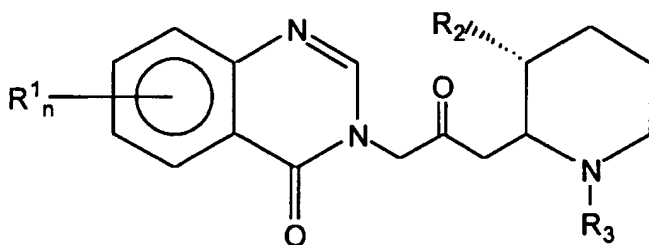


wherein:  $n=1-2$

- $R_1$  is at each occurrence independently selected from the group consisting of hydrogen, halogen, nitro, benzo, lower alkyl, phenyl and lower alkoxy;
- $R_2$  is a member of the group consisting of hydroxy, acetoxy and lower alkoxy; and
- $R_3$  is a member of the group consisting of hydrogen and lower alkenoxy-carbonyl; and pharmaceutically acceptable salts thereof.

22. The method according to claim 21 wherein the compound is halofuginone.

23. A method for improving the capacity of a cirrhotic liver to regenerate following partial hepatectomy by affecting the molecules in the signal transduction pathway of hepatocyte growth factor (HGF), comprising administering to an individual in need thereof a pharmaceutical composition comprising a therapeutically effective amount of a compound having the formula:

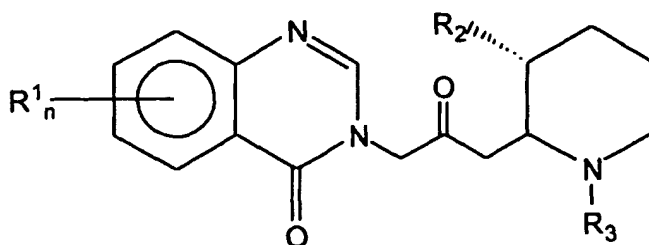


wherein:  $n=1-2$

- $R_1$  is at each occurrence independently selected from the group consisting of hydrogen, halogen, nitro, benzo, lower alkyl, phenyl and lower alkoxy;
- $R_2$  is a member of the group consisting of hydroxy, acetoxy and lower alkoxy; and
- $R_3$  is a member of the group consisting of hydrogen and lower alkenoxy-carbonyl; and pharmaceutically acceptable salts thereof.

24. The method according to claim 23 wherein the compound is halofuginone.

25. A method for increasing the amount of biologically active IGF-1, comprising administering to an individual a pharmaceutical composition comprising a therapeutically effective amount of a compound of the general formula:



wherein:  $n=1-2$

$R_1$  is at each occurrence independently selected from the group consisting of hydrogen, halogen, nitro, benzo, lower alkyl, phenyl and lower alkoxy;

$R_2$  is a member of the group consisting of hydroxy, acetoxy and lower alkoxy; and

$R_3$  is a member of the group consisting of hydrogen and lower alkenoxy-carbonyl; and pharmaceutically acceptable salts thereof.

26. The method according to claim 25 wherein the compound is halofuginone.